

What is claimed is:

1. An apparatus comprising:

a substrate including one or more passive alignment features in predetermined locations and configured to receive and passively align one or more optical modules; and

one or more optical modules, each module including an optical element aligned and secured to a base adapted to be received by the alignment features, each base secured to the substrate by cooperation with the passive alignment features.
2. The apparatus of claim 1, wherein the optical elements are secured to the bases at predetermined spatial and angular positions.
3. The apparatus of claim 1, wherein the optical elements are passively aligned on the bases with a flexible gripping element including a pair of spaced sidewalls defining a channel adapted to receive and secure the optical element to the substrate.
4. The apparatus of claim 1, wherein the bases are adapted to be secured to the substrate in various locations.
5. The apparatus of claim 1, wherein the passive alignment features include a flexible gripping element having a pair of spaced sidewalls defining a channel adapted to receive and secure the bases to the substrate.
6. The apparatus of claim 5, wherein sidewalls include upper portions and lower portions, and the spacing between the upper portions is less than the spacing between the lower portions.
7. The apparatus of claim 1, wherein the alignment features include a recessed region located in the surface of the substrate adapted to receive the bases.
8. The apparatus of claim 1, wherein the optical elements are selected from the group consisting of optical fiber, lensed fiber, prisms, filters, prisms including multiple thin film filters, switching elements such as a MEMS switches, lenses, graded index lenses, gratings, mirrors, MEMs mirrors, electroholographic switches, VCSEL arrays, variable optical attenuation elements, tunable filters and LCD switches.
9. The apparatus of claim 1, wherein the passive alignment features are standardized and the bases are standardized.

10. The apparatus of claim 1, wherein each of the bases can be secured to each of the alignment features in a plurality of standardized alignment features on the substrate.

11. An apparatus comprising:

a substrate including one or more alignment features in predetermined locations and configured to receive and align optical modules; and

one or more optical modules, each module including an optical element passively aligned and secured to a base adapted to be received by the alignment features, each base secured to the substrate by cooperation with the passive alignment features.

12. The apparatus of claim 11, wherein the alignment features are in predetermined locations on the substrate.

13. The apparatus of claim 11, wherein the alignment features are actively aligned on the substrate.

14. The apparatus of claim 13, wherein the alignment features include a flexible gripping element having a pair of spaced sidewalls defining a channel adapted to receive and secure the bases to the substrate.

15. An apparatus comprising:

a substrate having one or more receiving structures and one or more modular optical elements, each modular optical element including an optical element aligned on a base, each base adapted to be secured to the receiving structures such that the modular optical element is passively aligned on the substrate.

16. The apparatus of claim 15, wherein the receiving structures include a trench or groove adapted to receive the bases.

17. The apparatus of claim 15, wherein the receiving structure includes a flexible gripping element having a pair of sidewalls defining a channel.

18. The apparatus of claim 15, wherein the bases include standardized sizes and features adapted to cooperate with the receiving structures to secure the bases to the substrate.

19. The apparatus of claim 18, wherein each of the modular optical elements are interchangeable in each of the receiving structures.

20. A method of passively aligning optical elements comprising:
aligning and securing one or more optical elements to bases; and
securing and passively aligning one or more of the bases to a substrate.

21. The method of claim 20, wherein the bases are passively aligned and secured on the substrate by a receiving structure.

22. The method of claim 20, wherein the optical elements are secured to the bases by flexible gripping elements having a pair of spaced sidewalls defining a channel, the sidewalls adapted to hold the optical element in position on the base.

23. The method of claim 21, wherein the receiving structure includes a flexible gripping element having a pair of spaced sidewalls defining a channel, the sidewalls adapted to hold the base in position on the substrate.

24. The method of claim 23, wherein the bases are sized and shaped to cooperate with the gripping element to secure the base to the substrate.

25. The method of claim 23 wherein the bases are sized and shaped such that they are interchangeable in each of the receiving structures.

27. The method of claim 21, wherein the receiving structure includes a depression in the substrate adapted to hold the base in position on the substrate.

28. The method of claim 21, wherein the receiving structures and bases have predetermined and standardized sizes and features.